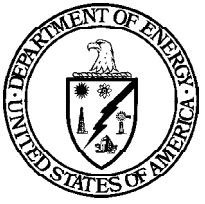
National Science Bowl®
Saturday Science Bowl
Seminars



May 6, 2000
National 4-H Conference Center
Chevy Chase, MD

Seminars by Times and Locations

Room	Session I 8:45 - 9:40 a.m.
Arkansas	*Proliferation of Nuclear Weapons: Cause For Concern* *Dr. Jim Finucane* *Facilitator: Steve Woodruff*
Colorado	*Materials Science Workshop for Teachers* *Charles Wright* *Facilitator: Royace Aikin*
Idaho	*Radionuclide Detection & Identification* *Steve Curtis* *Facilitator: Vince Shielack*
Illinois	*Climate Change: Where We Currently Stand* *Tom Grahame* *Facilitator: Jo Ann Rochon*
Minnesota	*Life, the Universe & Everything* *Dr. Paul Hertz* *Facilitator: Lilas Soukup*
Missouri	*Transgenic Creations of the Past, Present & Future* *Dr. Peter Faletra* *Facilitator: Kim Lievense*
Montana	*Plasma: The Ubiquitous Fourth State of Matter* *Dr. Lee Berry* *Facilitator: Claretta Sullivan*
Ohio	*Magnetism, Magnetic Fields & the Electric White House* *Paul Thomas "Mr. Magnet"* *Facilitator: Tim Bargen*
Oklahoma A	*Science and Baseball* *Dr. Robert Adair* *Facilitator: Debi Miles*

Session II 9:45 - 10:40 a.m.	Session III 10:45 - 11:40 a.m.
Neutron Science - A Tool to Understanding Our Material World *Dr. Jaime Fernandez-Baca* *Facilitator: Ray Ng*	*Proliferation of Nuclear Weapons* *Dr. Jim Finucane* *Facilitator: Steve Woodruff*
Materials Science Workshop *Charles Wright* *Facilitator: Royace Aikin*	*Materials Science Workshop* *Charles Wright* *Facilitator: Royace Aikin*
Driving Into The Future *Dr. Cloyd Beasley* *Facilitator: Tim Gerhart*	*Neutron Science* *Dr. Jaime Fernandez-Baca* *Facilitator: Shawn Sendlinger*
Deep Green *Dr. Elizabeth Zimmer* *Facilitator: Jan Tyler*	*Deep Green* *Dr. Elizabeth Zimmer* *Facilitator: Jan Tyler*
Big Bangs and Black Holes *Dr. Alan Bunner* *Facilitator: Kathy Ketner*	*Deadly Radiation - A Mixed Blessing?* *Dr. Myron Pollycove* *Facilitator: Kay Ball*
Transgenic Creations & Monsters *Dr. Peter Faletra* *Facilitator: Kim Lievense*	*The Human Genome Program* *Dr. Trevor Hawkins* *Facilitator: Debra Halliday*
Climate Change *Tom Grahame* *Facilitator: Jo Ann Rochon*	*Plasma: The Ubiquitous 4th State* *Dr. Lee Berry* *Facilitator: Claretta Sullivan*
Magnetism & the Electric White House *Paul Thomas "Mr. Magnet"* *Facilitator: Tim Bargen*	*Magnetism & the Electric White House* *Paul Thomas "Mr. Magnet"* *Facilitator: Tim Bargen*
Things You Never Considered *Scott McMullin* *Facilitator: Carol Milbrandt*	*Science and Baseball* *Dr. Robert Adair* *Facilitator: Debi Miles*

Science and Baseball

Dr. Robert Adair

Oklahoma
8:45 - 9:40
10:45 - 11:40

In this seminar, physics and neurophysiology principles will be demonstrated through baseball, America's favorite pasttime. In this exposition, Dr. Adair will consider the physics of the flight of the ball through the air, the physics of the collision of the bat with the ball, and the neurophysiology of the sensory system and neural networks that the batter uses to judge a pitch and to hit it – hopefully.

Robert Kemp Adair has been a Sterling Professor Emeritus of Physics, Senior Research Scientist at Yale University. At the University of Wisconsin, he earned a Ph.B, a M.Sc. (Physics), a Ph.D. (Physics), and a D.Sc. (Hon). Dr. Adair was a Physicist with Brookhaven National Laboratory from 1953 to 1959, and then he started his career at Yale University in 1959. At Yale he has been a Higgins Professor, Sterling Professor, Professor Emeritus, Senior Research Physicist, Department Chairman, and Director of the Division of Physical Sciences. In 1987, Dr. Adair became the Associate Director for High Energy and Nuclear Physics at Brookhaven National Laboratory. He has been a physicist to the National Baseball League, and his writings include: *Strange Particles* (with Earle Fowler), 1963; *Concepts in Physics*, 1969; *The Great Design*, 1987; and *The Physics of Baseball*, 1990.

Driving Into the Future
Dr. Cloyd Beasley

Idaho
9:45 - 10:40

How will scientific principles affect the future of car design? This seminar will describe the cutting edge technologies being employed in the development of vehicles capable of a factor of three decrease (3X) in fuel consumption over baseline (1993) vehicles. The technical challenges are comparable to our putting a man on the moon plus the additional constraint of economic viability, since, if the cars don't sell, they will have no beneficial effect on the environment.

The Partnership for a New Generation of Vehicles (PNGV) is a public-private R&D partnership launched by President Clinton, Vice President Gore and CEOs of the Big Three U.S. auto manufacturers in September 1993. Dr. Beasley is currently a Technical Coordinator for the PNGV program at the Dept. of Commerce.

Dr. Cloyd Beasley earned a B.A. and M.A. from Vanderbilt University, and went on to earn his PhD in physics/math from the Univ. of Wisconsin, Madison. He has worked for Oak Ridge National Laboratory researching theoretical plasma physics, and acting as a program manager for Energy Efficiency and Renewable Energy. His other experiences include working as a Culham Research Associate, Culham Laboratory (UK); a Max Planck Institute for Plasma Physics Fellow; a Plasma Subject Specialist, International Atomic Energy Agency (Vienna); and a specialist in chemical and glass industries.

Plasma: The Ubiquitous Fourth State of Matter

Dr. Lee Berry

Montana
8:45 - 9:40
10:45 - 11:40

Topics to be discussed include:
- What does ubiquitous mean?
- What is a plasma and where do we find them?
- How are plasmas made and what do they look like? (Short demonstration)
- Applications of plasmas
- Physics unknowns for plasmas-research issues

Lee Berry has been a Research Staff member at Oak Ridge National Laboratory for almost 30 years with a background in experimental and theoretical plasma physics. He is a Fellow in the American Physical Society and attended the University of California at Riverside for degrees in Physics and Mathematics. His research includes work on magnetic fusion, plasma processing of semiconductors, and the use of physics and technology developed in the fusion program for a variety of problems including paper and chemical processing. Current research topics include the use of radio frequency waves to drive plasma flows for the improvement of energy confinement in fusion plasmas, and the development of computational tools for designing improved magnetic fusion devices.

Big Bangs and Black Holes

Dr. Alan Bunner

Minnesota
9:45 - 10:40

Let's explore the wonderful and wacky world of black holes, cosmic explosions and dark matter. The past few years have seen a series of breakthroughs in our understanding of the Big Bang, the links between fundamental physics and astronomical observations, and the abundance of black holes in the universe. We'll touch on current views of the origin of the universe, the mystery of the missing mass, an inventory of black holes in our galaxy and beyond, and gamma-ray bursts. We'll speculate about some of the more weird theories in vogue today about our universe and others.

Dr. Alan Bunner is the Science Program Director for Structure & Evolution of the Universe at NASA Headquarters in Washington, D.C. As a member of the Office of Space Science (OSS) Board of Directors, he has responsibility for the science disciplines of high energy astrophysics, extreme ultraviolet astronomy, submillimeter and radio astronomy, relativistic astrophysics, and general relativity. Dr. Bunner previously served as Chief of the High Energy Astrophysics Branch at NASA Headquarters. He has served as Program Scientist for the Compton Gamma Ray Observatory and the Chandra X-ray Observatory. He came to NASA Headquarters in 1985 after holding the position of Principal Scientist at the Perkin-Elmer Corporation, where he led a variety of research programs and studies. From 1967 to 1979, Bunner was an Associate Scientist at the University of Wisconsin, specializing in x-ray astronomy research. Dr. Bunner received his B.A. in Mathematics and Physics from the University of Toronto in 1960 and his Ph.D. in Physics from Cornell University in 1967.

Radionuclide Detection and Identification for Environmental and Search Applications

Steve Curtis

Idaho

8:45 - 9:40

Increasingly, radionuclide identification has become more important as proliferation of nuclear material has increased, and as environmental concerns from the cold war weapons production and testing have escalated. Mr. Curtis will present the current methods used to detect and identify nuclear material either for contamination of the environment or location of lost or stolen radionuclides. The basic physics of detection will be discussed as well as the characteristics of detection material and electronics used in modern instruments.

Steve Curtis is a graduate of the University of Nevada, Las Vegas in Electronics Engineering. He has spent the last 18 years in the Health Physics arena and has worked for 9 years in the field of National Nuclear Counterterrorism Response. He has had assignments involving Russian Nuclear Verification of Weapons of Mass Destruction testing, integration of nuclear detection technology, and has worked on large conventional explosives experiments, both here and in the former Soviet Union.

Transgenic Creations and Monsters of the Past, Present, and Future

Dr. Peter Faletra

Missouri
8:45 - 9:40
9:45 - 10:40

The ability to easily move genes from one animal species to another or even a plant to an animal has created a number of staggering possibilities. Dr. Faletra's presentation will be based on the belief that, "Whatever scientists can do, they will do." This has already led to some genetic monsters in his view. He will present some moral questions and logical dilemmas that we as scientists and citizens will have to face in the near future because of the evolutionary power scientists now hold. Audience participation will be heartily encouraged.

Dr. Peter Faletra is currently an Einstein Fellow with the Department of Energy. He has also worked as an educator, X-ray systems designer, immunologist, and owner of a biotechnology company.

Neutron Science - A Tool to Understanding our Material World

Dr. Jaime Fernandez-Baca

Arkansas
9:45 - 10:40
Idaho
10:45 - 11:40

Neutrons have unique properties that help us to better understand the material world. From the understanding of the nature of materials, like the high-temperature superconductors and complex molecules to proteins and plastics, neutrons are an important tool that helps scientists to *engineer* and improve materials at the atomic level. In this talk the properties that make neutrons so unique for these studies will be presented. How neutron research affects the materials that we use in our everyday lives will also be discussed. Finally the neutron research facilities in the U.S. will be described, including the Spallation Neutron Source presently being built at Oak Ridge National Laboratory in Tennesee.

Jaime Fernandez-Baca was born and raised in Lima, Peru. While an undergraduate student he taught Physics at a private high school, and after graduating he joined the Peruvian Institute of Nuclear Energy in Lima, where he became interested in the applications of neutrons. In 1979, he was awarded the International Atomic Energy Agency (IAEA) fellowship which brought him to the U.S. He received his doctoral degree in Physics at the University of Maryland, College Park with a dissertation on neutron scattering studies in amorphous ferromagnets. He joined the scientific staff at Oak Ridge National Laboratory in Oak Ridge, Tennessee, where he is currently a senior research staff member of the neutron scattering group. His current research activities deal with studies of the magnetic ordering and spin dynamics of transition-metal alloys and disordered magnetic systems. Dr. Fernandez-Baca has authored over 70 research articles published in scientific journals and has edited one book.

Proliferation of Nuclear Weapons: Cause For Serious Concern

Dr. Jim Finucane

Arkansas
8:45 - 9:40
10:45 - 11:40

A brief history of the development of both nuclear weapons and the international nuclear non-proliferation efforts will be described. Some of the characteristics of the International Nuclear Non-Proliferation Regime will be described as it was originally. The problems encountered in the non-proliferation efforts are detailed – as well as some of the successes that have been achieved. Recent milestones in the non-proliferation effort will be described: 1995 NPT Extension Conference (where the NPT was indefinitely extended) and the 2000 NPT Review Conference (which is now underway in Geneva). Finally the current International Nuclear Non-Proliferation Status will be described in some detail – along with the underlying factors which lead to concern, and what can be done!

Dr. Jim Finucane earned a B.S. in Mechanical Engineering from Stanford University, a M.S. in Nuclear Engineering from the University of California, Berkeley, and a Ph.D. in Nuclear Engineering from the University of California, Berkeley. He served four years active duty in the U.S. Navy on the Nuclear Propulsion Program. From 1992 to 1997, he worked five years for the International Atomic Energy Agency in Austria. In his 20th year working for the Department of Energy, he is currently responsible for directing a program to collect data for the Nuclear Waste Disposal Program, preparing projections of worldwide inventories of civil plutonium, working to implement U.S. contributions to the Strengthening International Safeguards Program, and working to develop Nuclear Proliferation Risk Assessment Methodology.

Climate Change: Where We Currently Stand

Tom Grahame

Illinois
8:45 - 9:40
Montana
9:45 - 10:40

Scientific opinion is coalescing on several crucial climate change issues: temperatures are rising, and the rate of increase seems to be accelerating; both greenhouse gas (GHG) emissions and natural causes have a role in this increase, although in the last three decades, the role of GHGs has become more dominant; and the possibility of non-linear warming events cannot be easily discounted. As a result, both scientific and public opinion appear to moving toward consensus that actions to limit atmospheric GHG levels in the long term will be necessary.

Thomas J. Grahame has worked on electricity and environmental issues, with emphasis on economics, for the last twenty-four years, including the last twenty-two at the Department of Energy (DOE). Prior to his DOE work, he analyzed energy issues for a U.S. Senator serving on the U.S. Senate Energy and Natural Resources Committee, where much of his time was involved with the Public Utility Regulatory Policies Act (PURPA), a law that began to open the door to electricity competition in the early 1980s. While working at the Massachusetts Energy Policy Office in 1976, Mr. Grahame wrote the first state energy conservation plan for Massachusetts.

Mr. Grahame has also given a number of talks on issues as far-ranging as the potential impact of the internet economy on economic growth (and hence, possibly, on electricity usage) and on the many issues raised by greenhouse gas emissions and our ever-widening capabilities to detect minute changes in temperature and other climate parameters as far back as tens of millions of years.

The Human Genome Program: Past, Present, and Future

Dr. Trevor Hawkins

Missouri
10:45 - 11:40

The U.S. DOE founded the Human Genome Program in 1986 as a method to track and understand mutations in DNA caused by background irradiation. The project has since flourished into an international effort and is the most important landmark for biomedical research and the foundation for medical research for the next century.

Trevor Hawkins, Ph.D., is a molecular biologist, automation expert and a manager. He obtained his B.Sc at the University of Sussex in the UK and then went on to work under Dr. John Sulson at the MRC Laboratory of Molecular Biology to complete his Ph.D in biochemistry working on the very start of the *C.elegans* genome sequencing project. During his Ph.D, Dr. Hawkins sequenced the very first *C.elegans* genomic clones using entirely fluorescent means and developed methods and approaches for shotgun sequencing and finishing that are still being applied today.

In March of 1999, Dr. Hawkins moved to the U.S. Department of Energy to become the Sequencing Director and now the Deputy Director of the Joint Genome Institute (JGI). His primary mission is to define and expand the JGIs DNA sequencing abilities and to set up functional and proteomic-based programs. The JGI has six sites in the U.S. with its headquarters being in Walnut Creek, California, where a genome campus is being developed. Today the JGI is the second largest contributor of draft sequence to the public databases and has sequencing programs in human, mouse and several microorganisms, as well as cDNA, expression and protein characterization based programs.

Life, the Universe & Everything

Dr. Paul Hertz

Minnesota
8:45 - 9:40

One of the great intellectual achievements of humankind has been determining the origin of the elements from which stars, planets, and even life forms are made. Based essentially on astronomical observations, coupled with our knowledge of the laws of physics, chemistry, and biology, we can understand what the contents of the Universe were following the Big Bang and how the simplest atoms formed during this period. The evolution of Universe, from the formation of the first stars to the formation of our Solar System, will be discussed. In particular, Dr. Hertz will explain where the more complex atoms were created and how the building blocks of life, such as carbon, oxygen, and iron, came to be available on the primitive Earth.

Paul Hertz is a Senior Scientist at NASA Headquarters. He recently left the Naval Research Laboratory in Washington, D.C., where he spent fifteen years as an astrophysicist studying compact objects, including neutron stars and black holes, using space-based detectors and telescopes. His recent research projects have investigated the orbital dynamics of binary stars. Dr. Hertz has been a co-investigator on several space missions including the currently orbiting Unconventional Stellar Aspect (USA) Experiment. He is also an Associate Professor of Computational Sciences and Space Sciences at George Mason University. In the distant past, Dr. Hertz received degrees from MIT and Harvard University.

Things You Never Considered
Scott McMullin

Oklahoma
9:45 - 10:40

Strategies to clean up the environment over the last 30 years have changed significantly. We can look back with amazement and wonder why people did the things they did. Both science and engineering disciplines are bound by the current state of knowledge. When we look at the historical efforts from our current understanding, we can begin to understand the past. By doing so, we must also look at what will be the future impacts, resulting from the perspectives of today. The U.S. Department of Energy is responsible for a number of waste sites containing both hazardous and radioactive wastes. Current research efforts to find better ways to clean up these waste sites are moving into areas which we once thought impossible to achieve. Some of these efforts include melting and freezing the soil; manipulating the redox of the soil and contaminants *in situ*; and using electro-kinetics to collect contaminants.

Scott R. McMullin is currently at the U.S. Department of Energy Savannah River Site/Subsurface Contaminants Focus Area. He has worked in the environmental and engineering field since 1980. He earned a Masters of Science, Civil Engineering/Geotechnical, and a Bachelor of Science, Civil Engineering, from Brigham Young University in Provo, Utah.

Deadly Radiation - A Mixed Blessing?

Dr. Myron Pollycove

Minnesota

10:45 - 11:40

The genes in every cell continuously undergo an immense amount of metabolic damage by reactive oxygen species (ROS) which is prevented, repaired and removed by a complex antimutagenic system. Recent studies document low dose radiation stimulation of many cellular functions, including antioxidant prevention, enzymatic repair, and apoptotic and immunological removal of DNA damage. This homeostatic system is stimulated by a ten or even a hundredfold increase in background radiation. Enhanced prevention of gene mutations by the spatial and temporal differences of ionizing radiation ROS is associated with radiation hormesis: decreased mortality and decreased cancer mortality observed in populations exposed to low dose radiation. Low dose radiation stimulation of the immune system prevents and removes cancer metastases in mice, rats, and humans.

Myron Pollycove, M.D., is the Special Assistant to the Deputy EDO, U.S. Nuclear Regulatory Commission and Professor Emeritus Laboratory Medicine and Radiology, University of California San Francisco. Dr. Pollycove received his B.S. Physics degree from CalTech in 1942 and he joined the U.S. Army Medical Corps, participated in the Korean War and worked in the Biophysics Division, Army Chemical Center, for two years. After completing his Harvard-Tufts Internal Medicine residency, for six years he investigated iron kinetics and intermediary metabolism as a Research Associate at the Lawrence Radiation Laboratory, UC Berkeley. During 1962-1991, while Director of the Clinical Laboratories and Chairman, Nuclear Medicine Department San Francisco General Hospital, he taught Nuclear Medicine and Laboratory Medicine at UCSF and SFGH. He was also actively involved in research in those areas. He is a member of national and international organizations representing Nuclear Medicine, Hematology, and Clinical Pathology.

Magnetism, Magnetic Fields and the Electric White House

Paul Thomas

Ohio
8:45 - 9:40
9:45 - 10:40
10:45 - 11:40

Take a mesmerizing journey of discovery into the fascinating realm of magnetic phenomena. Paul Thomas, better known at MIT as Mr. Magnet, will uncover before your eyes the secret forces of ferromagnetism and magneto-electricity. What mysterious force field holds steady an aluminum fry pan suspended in space? A magnetic impulse launches Garfield into space and with sudden forceful energy bends metal into a useful shape. Light up The White House by generating electric energy with your muscle power. How many watts can you generate? If you dare, discharge one million volts of electric potential holding a lightning rod in your bare hands. The Mr. Magnet show is just for the fun of it.

Paul Thomas is currently a Plasma Science and Fusion Center Technical Supervisor at MIT. After graduating from technical school, Mr. Thomas joined High Voltage Engineering Corporation, where he worked under the guidance of Robert J. Van de Graaff to develop high voltage apparatus for research. He pursued a degree in electrical engineering at Northeastern University. Mr. Thomas joined the Massachusetts Institute of Technology in 1983, where as part of a team of scientists and engineers, he supervised the integration of computer controls on a large-scale fusion experiment. Nine years later, Mr. Thomas began his educational outreach by building a series of demonstrations and bringing them in a van into Boston area schools. In the 8 years since the first school visit, Mr. Magnet has presented the program to nearly 300,000 students and teachers in the New England region. The show has also traveled to New Orleans, Atlanta, and Washington, D.C. for special events.

Materials Science Workshop for Teachers

Charles Wright

Colorado
8:45 - 11:40

This three-hour workshop is designed to share the *Materials Science and Technology Handbook* developed by the Pacific Northwest Laboratory in Richland, Washington, with support from the U.S. Department of Energy. Using various hands-on activities, participants will experience the *stuff* of materials technology. Mr. Wright will discuss how Materials Science and Technology can be integrated into various classes or taught as a stand-alone subject. The following questions will be answered. What is Materials Science and Technology? Why teach it? Why is it so popular? Why is it so important? Participants should come prepared to *get their hands dirty!*

Charles Wright has earned a Bachelor of Arts and Education Degree in Science from Pacific Lutheran University and a Master of Education Degree from Lesley College. He is certified as a Washington State Continuing Elementary and Secondary Teacher and has an Endorsement in Traffic Safety. He is currently a Consultant for Gault Middle School Magnet Program/Material Science in Tacoma, Washington. Before that, he worked for 31 years in the Bethel School District teaching grades 6 to 12. He has attended Materials Science Training at University of Washington Seattle and Pacific Northwest Laboratory, and was a GTE GIFT Fellow. Since 1996, he has taught Materials Science and Technology Training Workshops to elementary and junior high teachers in the Highline School District.

Deep Green
Dr. Elizabeth Zimmer

Illinois
9:45 - 10:40
10:45 - 11:40

In 1992, several botanists hatched a plan for a botanical version on the Human Genome Project – an effort to merge molecular, fossil, and morphological data to build a family tree for all green plants. The 200 scientists from 12 countries dubbed the project *Deep Green.* Challenging long-held notions about the relationships between species, scientists reported that plants should be divided into three kingdoms rather than one, unveiled the most primitive living flowering species, and homed in on the Eve or mother, of all 500,000 green plant species. As genetic data add branches and leaves to the new family tree, biologists should be able to tap it for information on how to engineer useful traits, fight invasive species, identify organisms, and find potential medicines.

Dr. Liz Zimmer is Principal Investigator and Curator of Botany at the Laboratory of Molecular Systematics of the National Museum of Natural History (NMNH) at the Smithsonian Institution. She also is Adjunct Professor at the University of Maryland and Duke, George Washington and Louisiana State Universities and a Research Fellow of Rancho Santa Ana Botanical Garden in Claremont, California. She earned her B.S. in Biological Sciences from Cornell University in 1973 and her Ph.D. in Biochemistry from UC Berkeley in 1981. Her dissertation work explored DNA variation in the blood proteins/hemoglobins of apes and humans; her thesis figures are used as examples of restriction maps in the textbook, *Molecular Biology of the Cell*. Dr. Zimmer received postdoctoral fellowships from the NIH and from Monsanto to work at Stanford University and Washington University to begin work on applications of DNA sequencing to understanding relationships among green plants.